

WHAT IS CLAIMED IS:

1. A shape-memory polybutylene terephthalate laminate film comprising a polybutylene terephthalate film, and at least one selected from the group consisting of a paper sheet, another resin film and a metal foil or  
5 a laminate comprising it, which has a first shape memorized in a predetermined temperature range.
2. The shape-memory polybutylene terephthalate laminate film according to claim 1, which is deformed to a second shape in a different temperature range from said predetermined temperature range.
- 10 3. The shape-memory polybutylene terephthalate laminate film according to claim 2, which substantially recovers said first shape from said second shape when exposed to a temperature at which said first shape is memorized.
4. The shape-memory polybutylene terephthalate laminate film  
15 according to claim 3, wherein the temperature at which said first shape is recovered is the glass transition temperature of said polybutylene terephthalate or lower.
5. The shape-memory polybutylene terephthalate laminate film according to claim 4, wherein the temperature at which said first shape is  
20 recovered is 35°C or lower.
6. The shape-memory polybutylene terephthalate laminate film according to claim 3, wherein the temperature at which said first shape is recovered is higher than the glass transition temperature and lower than the melting point of said polybutylene terephthalate.
- 25 7. The shape-memory polybutylene terephthalate laminate film according to claim 6, wherein the temperature at which said first shape is recovered is 75 to 100°C.
8. The shape-memory polybutylene terephthalate laminate film

according to any one of claims 2 to 7, wherein said first shape is a curled shape, and said second shape is substantially a flat shape or an oppositely curled shape.

9. The shape-memory polybutylene terephthalate laminate film

5 according to any one of claims 1 to 8, which has at least one entire surface provided with a lot of substantially parallel linear scratches, whereby it can be torn substantially straight along said linear scratches from any point.

10. The shape-memory polybutylene terephthalate laminate film

according to claim 9, wherein the depth of said linear scratches is 1 to 40%  
10 of the thickness of said polybutylene terephthalate film.

11. The shape-memory polybutylene terephthalate laminate film

according to claim 9 or 10, wherein the depth of said linear scratches is 0.1 to 10  $\mu\text{m}$ , and the width of said linear scratches is 0.1 to 10  $\mu\text{m}$ ; and wherein the intervals of said linear scratches are 10 to 200  $\mu\text{m}$ .

15 12. The shape-memory polybutylene terephthalate laminate film according to any one of claims 9 to 11, which has at least one surface vapor-deposited with a ceramic or a metal.

13. The shape-memory polybutylene terephthalate laminate film

according to any one of claims 1 to 12, which has a layer structure  
20 comprising said polybutylene terephthalate film, said paper sheet and a sealant film in this order.

14. The shape-memory polybutylene terephthalate laminate film

according to any one of claims 1 to 12, which has a layer structure  
comprising said polybutylene terephthalate film, said paper sheet, a rigid  
25 film and a sealant film in this order.

15. The shape-memory polybutylene terephthalate laminate film

according to any one of claims 1 to 12, which has a layer structure  
comprising said polybutylene terephthalate film, a rigid film and a sealant

film in this order.

16. The shape-memory polybutylene terephthalate laminate film according to any one of claims 13 to 15, which has a light-screening ink layer on a surface of said polybutylene terephthalate film on the side of said  
5 paper sheet, or on a surface of said rigid film on the side of said sealant film.
17. A package sheet constituted by the shape-memory polybutylene terephthalate laminate film recited in any one of claims 1 to 16.
18. A container lid constituted by the shape-memory polybutylene  
10 terephthalate laminate film recited in any one of claims 1 to 16.
19. A method for producing a shape-memory polybutylene terephthalate laminate film comprising (a) a polybutylene terephthalate film, and (b) at least one selected from the group consisting of a paper sheet, another resin film and a metal foil, or a laminate comprising it, said  
15 method comprising the steps of (1) subjecting a laminate film comprising said polybutylene terephthalate film and another film or film laminate to a shaping treatment at a temperature  $T_1$  equal to or lower than the glass transition temperature of said polybutylene terephthalate while maintaining a first shape; (2) deforming the shaped laminate film to a second shape at a  
20 temperature  $T_2$  higher than said glass transition temperature; and (3) cooling said laminate film to a temperature  $T_3$  equal to or lower than said glass transition temperature so that said laminate film is fixed to said second shape.
20. The method for producing a shape-memory polybutylene  
25 terephthalate laminate film according to claim 19, wherein said first shape is a curled shape, and said second shape is substantially a flat shape or an oppositely curled shape.
21. The method for producing a shape-memory polybutylene

terephthalate laminate film according to claim 20, wherein a laminate film comprising said polybutylene terephthalate film adhered to another film or film laminate is conveyed by a roll, such that said laminate film is worked along a peripheral surface of said roll at said temperature  $T_1$  to have a  
5 curled shape.

22. The method for producing a shape-memory polybutylene terephthalate laminate film according to any one of claims 19 to 21, wherein said laminate film is deformed at said temperature  $T_2$  for 30 to 60 seconds.

10 23. The method for producing a shape-memory polybutylene terephthalate laminate film according to any one of claims 19 to 22, wherein said temperature  $T_1$  is 35°C or lower, said temperature  $T_2$  is higher than 45°C and 65°C or lower, and said temperature  $T_3$  is 15 to 25°C.

15 24. The method for producing a shape-memory polybutylene terephthalate laminate film according to any one of claims 19 to 23, wherein said temperature  $T_1$  is 15 to 25°C.

25. The method for producing a shape-memory polybutylene terephthalate laminate film according to any one of claims 20 to 24, wherein the curled laminate film is cooled to said temperature  $T_3$ , and then  
20 wound in an uncurling direction.

26. The method for producing a shape-memory polybutylene terephthalate laminate film according to any one of claims 19 to 25, wherein a tension of 4 kgf/m (width) or more is applied to said polybutylene terephthalate film when said polybutylene terephthalate film  
25 is adhered to another film or film laminate.

27. The method for producing a shape-memory polybutylene terephthalate laminate film according to claim 26, wherein said tension is 10 to 20 kgf/m (width).

28. A method for producing a shape-memory polybutylene terephthalate laminate film comprising (a) polybutylene terephthalate film, and (b) at least one selected from the group consisting of a paper sheet, another resin film and a metal foil, or a laminate comprising it, said method
- 5 comprising the steps of (1) (i) laminating said polybutylene terephthalate film with another film or film laminate, after a shaping treatment at a temperature  $T_4$  higher than the glass transition temperature and lower than the melting point of said polybutylene terephthalate while maintaining said polybutylene terephthalate film in a first shape, or (ii) producing a laminate
- 10 film of said polybutylene terephthalate film and another film or film laminate in advance, and subjecting it to a shaping treatment at said temperature  $T_4$  while maintaining it in the first shape to produce the shaped laminate film having said first shape; (2) cooling the shaped laminate film to a temperature  $T_5$  equal to or lower than said glass transition temperature
- 15 to fix it to said first shape; (3) deforming said shaped laminate film to a second shape at a temperature  $T_6$  higher than said glass transition temperature and lower than said temperature  $T_4$ ; and then (4) cooling the deformed laminate film to a temperature  $T_7$  equal to or lower than said glass transition temperature to fix it to said second shape.
- 20 29. The method for producing a shape-memory polybutylene terephthalate laminate film according to claim 28, wherein said first shape is a curled shape, and said second shape is substantially a flat shape or an oppositely curled shape.
30. The method for producing a shape-memory polybutylene
- 25 terephthalate laminate film according to claim 28 or 29, wherein said temperature  $T_4$  is 75 to 100°C; said temperature  $T_5$  is 40°C or lower; said temperature  $T_6$  is 45 to 65°C; and said temperature  $T_7$  is 40°C or lower.
31. The method for producing a shape-memory polybutylene

terephthalate laminate film according to claim 29 or 30, comprising conveying said polybutylene terephthalate film in contact with a peripheral surface of one of a pair of heat rolls, heating it at said temperature  $T_4$  along the peripheral surface of said heat roll to provide said polybutylene

5 terephthalate film with a curled shape, and then continuously adhering the curled polybutylene terephthalate film to another film or film laminate by causing them to pass through a pair of said heat rolls, thereby providing a curled laminate film.

32. The method for producing a shape-memory polybutylene  
10 terephthalate laminate film according to claim 29 or 30, wherein said polybutylene terephthalate laminate film is conveyed by a heat roll to treat it at said temperature  $T_4$  along the peripheral surface of said heat roll.

33. The method for producing a shape-memory polybutylene  
15 terephthalate laminate film according to any one of claims 28 to 32, wherein a tension of 4 kgf/m (width) or more is applied to said polybutylene terephthalate film at the time of adhering said polybutylene terephthalate film to another film or film laminate.

34. The method for producing a shape-memory polybutylene  
20 terephthalate laminate film according to claim 33, wherein said tension is 10 to 20 kgf/m (width).

35. The method for producing a shape-memory polybutylene  
terephthalate laminate film according to any one of claims 29 to 34,  
wherein the curled laminate film is cooled to said temperature  $T_5$ , wound in  
an uncurling direction, and then treated at said temperature  $T_6$  or lower and  
25 said temperature  $T_7$ .

36. A method for producing a container having a lid heat-sealed to a  
container body, said lid being composed of the shape-memory  
polybutylene terephthalate laminate film recited in any one of claims 1 to

16, comprising the steps of annealing said shape-memory polybutylene terephthalate laminate film at a temperature  $T_g$  higher than the glass transition temperature of said polybutylene terephthalate while keeping it flat; and punching and heat-sealing the resultant substantially flat

- 5 shape-memory polybutylene terephthalate laminate film to said container body by a lid-sealing means, thereby adhering said lid composed of said shape-memory polybutylene terephthalate laminate film to said container.

37. The method for producing a container having a lid composed of a shape-memory polybutylene terephthalate laminate film according to claim  
10 36, wherein said annealing is conducted for 30 to 60 seconds.

38. The method for producing a container having a lid composed of a shape-memory polybutylene terephthalate laminate film according to claim 36 or 37, wherein said temperature  $T_g$  is 80 to 120°C.

39. A method for producing a polybutylene terephthalate film from a  
15 polybutylene terephthalate resin by an air-cooled inflation method, comprising the steps of ejecting a humid air through a first cooling ring disposed near an annular die to cool a neck portion of a bubble at a blow-up ratio of 1.5 to 2.8, a resin extrusion temperature of 210 to 250°C, and a resin-extruding pressure of 9.8 to 13.7 MPa.

20 40. The method for producing a polybutylene terephthalate film according to claim 39, wherein said bubble is further cooled by a cooling air ejecting from the second cooling ring disposed slightly above a frost line of said bubble; and wherein the temperature around a cylindrical net disposed between said first cooling ring and said second cooling ring is  
25 kept constant, thereby stabilizing the temperature of said bubble cooled by said first cooling ring and said second cooling ring.

41. The method for producing a polybutylene terephthalate film according to claim 39 or 40, wherein a humid air ejected from a

cooling-air-ejecting means disposed in a lower portion of said net is blown up along an outer surface of said cylindrical net, to cool the surrounding of said net.

42. The method for producing a polybutylene terephthalate film  
5 according to any one of claims 39 to 41, wherein said bubble is further cooled by a third cooling ring disposed slightly above said second cooling ring.

43. The method for producing a polybutylene terephthalate film according to any one of claims 39 to 42, wherein the cooling air ejected  
10 from said second cooling ring and said third cooling ring is a humid air.

44. The method for producing a polybutylene terephthalate film according to any one of claims 39 to 43, wherein the temperature of said humid air is 15 to 25°C.

45. An easy-to-straight-tear polybutylene terephthalate film comprising  
15 a polybutylene terephthalate film having a lot of substantially parallel linear scratches at least one entire surface, so that it can be torn substantially straight along said linear scratches from any point.

46. The easy-to-straight-tear polybutylene terephthalate film according to claim 45, wherein the depth of said linear scratches is 1 to 40% of the  
20 film thickness.

47. The easy-to-straight-tear polybutylene terephthalate film according to claim 45 or 46, wherein the depth of said linear scratches is 0.1 to 10  $\mu\text{m}$ .

48. The easy-to-straight-tear polybutylene terephthalate film according  
25 to any one of claims 45 to 47, wherein the width of said linear scratches is 0.1 to 10  $\mu\text{m}$ .

49. The easy-to-straight-tear polybutylene terephthalate film according to any one of claims 45 to 48, wherein the intervals of said linear scratches



are 10 to 200  $\mu\text{m}$ .

50. The easy-to-straight-tear polybutylene terephthalate film according to any one of claims 45 to 49, wherein a lot of fine penetrating pores and/or non-penetrating pores are uniformly formed.

5 51. The easy-to-straight-tear polybutylene terephthalate film according to any one of claims 45 to 50, wherein said easy-to-straight-tear polybutylene terephthalate film is a single-layer film or a laminate film.

52. The easy-to-straight-tear polybutylene terephthalate film according to claim 51, wherein said laminate film comprises at least one layer  
10 composed of a film having said linear scratches, and a sealant film layer.

53. The easy-to-straight-tear polybutylene terephthalate film according to any one of claims 45 to 52, wherein a ceramic or a metal is vapor-deposited thereon.

54. A package sheet composed of the easy-to-straight-tear polybutylene  
15 terephthalate film recited in any one of claims 45 to 53.

55. A porous polybutylene terephthalate film comprising a polybutylene terephthalate film having a lot of fine penetrating pores and/or non-penetrating pores formed uniformly, thereby having good twist retention.

20 56. The porous polybutylene terephthalate film according to claim 55, wherein said fine pores having an average opening diameter of 0.5 to 100  $\mu\text{m}$  at a density of 500/ $\text{cm}^2$  or more.

57. A package sheet composed of the porous polybutylene terephthalate film recited in claim 55 or 56.